D.) AMENDMENTS TO THE DRAWINGS

None.

E.) REMARKS

This Response is filed in response to the Office Action dated September 23, 2004.

Upon entry of this Response, claims 1-20 will be pending in the Application.

In the outstanding Office Action, the Examiner maintained the objection to the drawings; and rejected claims 1-20 under 35 U.S.C. § 103(a) as being unpatentable over the D'Angelo et al. article from 1993 entitled "A New Finite Element Formation for RF Scattering by Complex Bodies of Revolution" in view of the Barka et al. article from 1999 entitled "An Efficient Algorithm for the RCS Modulation Prediction from Jet Inlet Engines."

Rejection under 35 U.S.C. 103

The Examiner rejected claims 1-20 under 35 U.S.C. § 103(a) as being unpatentable over the D'Angelo et al. article from 1993 entitled "A New Finite Element Formation for RF Scattering by Complex Bodies of Revolution," hereinafter referred to as "the D'Angelo Article," in view of the Barka et al. article from 1999 entitled "An Efficient Algorithm for the RCS Modulation Prediction from Jet Inlet Engines," hereinafter referred to as "the Barka Article."

Specifically, the Examiner stated that

> D' Angelo et al. teaches solving electromagnetic scattering from complex inhomogeneous axi-symmetric bodies using finite element analysis; but is not tailored to specific axi-symmetric aircraft related devices.
>
> Barka et at. teaches using electromagnetic scattering from the interior of a complex jet engine inlet to contribute to the overall radar cross section (RCS) of a modern jet aircraft.
>
> At the time the invention, it would have been obvious to one of ordinary skill in the art to use Barka et al. to modify D' Angelo et al. since it would be advantageous to capture the RCS from another dimension [in] space for an precise 3-D representation.
>
> Claim 1. A method of calculating a radar cross section of an aircraft component having an axi-periodic structure comprising the steps of (Barka: pg. 2566, lines 1-3 and 11; D'Angelo: pg.534, abstract): creating a finite element model for the aircraft component describing electromagnetic characteristics of the aircraft component (Barka: pg. 2566, Introduction); transforming the finite element model into a plurality of independent modes (Barka: pg. 2567, lines 11-12); determining, for each independent mode of the plurality of independent mode (Barka: pg. 2566, lines 19-22); a portion of an electromagnetic field contributed

by each independent mode(Barka: pg. 2567, lines 11-12); summing the portion of the electromagnetic field contributed by each independent mode of the plurality of independent modes to calculate a total electromagnetic field for the aircraft component (D'Angelo: pg. 538, equation 21); and determining the radar cross section for the aircraft component from the total electromagnetic field (Barka: Introduction; D'Angelo: section III, Radar Cross Section Calculation, pg.537-539). ...

Claim 13. A computer program (Barka: pg. 2567, lines 5-12) product embodied on a computer readable medium and executable by a computer for calculating the radar cross section (RCS) of an aircraft engine face component, the computer program product comprising computer instructions for executing the steps of creating a finite element model for the aircraft engine face component describing electromagnetic characteristics of the aircraft engine face component (Barka: pg. 2566, lines 1-3 and 11; D'Angelo: pg.534, abstract); transforming the finite element model into a plurality of independent modes(Barka: pg. 2567, lines 5-12); determining, for each independent mode of the plurality of independent modes, a portion of an electromagnetic field contributed by each independent mode (Barka: pg. 2567, lines 18-34); summing the portion of the electromagnetic field contributed by each independent mode of the plurality of independent modes to calculate a total electromagnetic far-field for the aircraft engine face component (D'Angelo: pg. 537, equation 17); and determining the radar cross-section for the aircraft engine face component from the total electromagnetic far-field (D'Angelo: pg.537, equation 18). ...

Claim 17. A system for calculating the radar cross section (RCS) of an aircraft engine component comprising (Barka: pg. 2566, lines 1-3 and 11; D'Angelo: pg.534, abstract): a computer having memory and a processing unit; means for creating a finite element model for the aircraft engine component describing electromagnetic characteristics of the aircraft engine component (Barka: pg. 2566, lines 1-3 and 11; D'Angelo: pg.534, abstract); means for transforming the finite element model into a plurality of independent modes (Barka: pg. 2566, lines 11-18); means for determining, for each independent mode of the plurality of independent modes, a portion of an electromagnetic near-field contributed by each independent mode (Barka: pg. 2566, lines 11-18 and pg. 2567, lines 21-22); and means for summing the portion of the electromagnetic near-field contributed by each independent mode of the plurality of independent modes to calculate a total electromagnetic near-field for the aircraft engine component(Barka: pg. 2566, lines 11-18); means for determining a total electromagnetic far-field for the aircraft engine component from the total electromagnetic near-field for the aircraft engine component(Barka: pg. 2566, lines 11-18); and means for determining the radar cross section for the aircraft engine component from the total electromagnetic far-field (Barka: pg. 2567, lines 18-34).

Applicants respectfully traverse the rejection of claims 1-20 under 35 U.S.C. § 103(a).

The D'Angelo Article, as understood, is directed to a design tool that provides information on scattering and radiation from complex objects that are axially symmetric. A direct three component formulation is used to solve for all three components of the electrical and magnetic fields over the domain of computation. An absorbing boundary condition is then performed directly without any interpolations to truncate the open regions surrounding the scatterer. The tool uses a final model Galerkin-finite element form for a given modal field to give the near fields inside the truncated domain. The radar cross section can be computed using a harmonic series expansion or a Green integral representation.

It is noted that the Examiner has not provided all of the pages of the D'Angelo article as page 538 is missing. Thus, Applicant's understanding of the D'Angelo article is based on the pages provided by the Examiner.

The Barka Article, as understood, is directed to an algorithm providing the radar modulation due to a set of rotating blades computed with only one solution for any blade position. The algorithm is used with a multidomain and multimethod coupling scheme based on generalized scattering matrix computations that is suitable in a context of parametric investigations. The algorithm writes the scattering matrix in a new base using a passing matrix. The passing matrix for a rotation angle has been shown to be analytical along with the inverse for the passing matrix and both the passing matrix and its inverse has no more than two non-zero coefficients in each row. The scattering matrix for a blade position is then determined in terms of the passing matrix and its inverse. Finally, the total number of operations that are needed to determine the scattering matrices associated with a set number of different positions of the engine blades is based on the total number of edge unknowns and the number of modal functions on the interface.

In contrast, independent claim 1 recites a method of calculating a radar cross section of an aircraft component having an axi-periodic structure comprising the steps of: creating a finite element model for the aircraft component describing electromagnetic characteristics of the aircraft component; transforming the finite element model into a plurality of independent modes; determining, for each independent mode of the plurality of independent modes, a portion of an

electromagnetic field contributed by each independent mode; summing the portion of the electromagnetic field contributed by each independent mode of the plurality of independent modes to calculate a total electromagnetic field for the aircraft component; and determining the radar cross section for the aircraft component from the total electromagnetic field.

Independent claim 13 recites a computer program product embodied on a computer readable medium and executable by a computer for calculating the radar cross section (RCS) of an aircraft engine face component, the computer program product comprising computer instructions for executing the steps of: creating a finite element model for the aircraft engine face component describing electromagnetic characteristics of the aircraft engine face component; transforming the finite element model into a plurality of independent modes; determining, for each independent mode of the plurality of independent modes, a portion of an electromagnetic field contributed by each independent mode; summing the portion of the electromagnetic field contributed by each independent mode of the plurality of independent modes to calculate a total electromagnetic far-field for the aircraft engine face component; and determining the radar cross section for the aircraft engine face component from the total electromagnetic far-field.

Independent claim 17 recites a system for calculating the radar cross section (RCS) of an aircraft engine component comprising: a computer having memory and a processing unit; means for creating a finite element model for the aircraft engine component describing electromagnetic characteristics of the aircraft engine component; means for transforming the finite element model into a plurality of independent modes; means for determining, for each independent mode of the plurality of independent modes, a portion of an electromagnetic near-field contributed by each independent mode; and means for summing the portion of the electromagnetic near-field contributed by each independent mode of the plurality of independent modes to calculate a total electromagnetic near-field for the aircraft engine component; means for determining a total electromagnetic far-field for the aircraft engine component from the total electromagnetic near-field for the aircraft engine component; and means for determining the radar cross section for the aircraft engine component from the total electromagnetic far-field.

To begin Applicant would like to point out the following:

> To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180

> USPQ 580 (CCPA 1974). "All words in a claim must be considered in judging the patentability of that claim against the prior art." *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970). If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988).

See Manual of Patent Examining Procedure, 8th Edition (MPEP) § 2143.03.

Several of the features recited by Applicant in independent claims 1, 13 and 17 are not taught or suggested by the D'Angelo Article and the Barka Article. First, neither the D'Angelo Article nor the Barka Article teaches or suggests transforming the finite element model into a plurality of independent modes as recited by Applicant in independent claims 1, 13 and 17. In the D'Angelo Article, the radar cross section is calculated by using a harmonic series expansion or Green integral representation on the final model Galerkin-finite element form. In the Barka Article, the scattering matrix is to be written in a new base and is then defined in terms of a passing matrix. The Examiner alleges that the Barka Article discloses the transformation of the finite element model into a plurality of independent modes at page 2567, lines 5-12. However, this passage discusses the use of the passing matrix as described above. Applicant submits that the changing of the base of the scattering matrix with the passing matrix is not a transformation of the finite element model and furthermore, the usage of the passing matrix in the Barka Article does not result in a plurality of independent modes as recited by Applicant in the independent claims. The Examiner is requested to explain how the changing of the base of the scattering matrix with a passing function, which results in a scattering matrix, can be considered a transformation into a plurality of independent modes. Thus, since the D'Angelo Article and the Barka Article do not teach or suggest all of the limitations recited in independent claims 1, 13 and 17, Applicant respectfully submits that the D'Angelo Article and the Barka Article do not render Applicant's invention as recited in independent claims 1, 13 and 17 obvious.

Furthermore, the D'Angelo Article and the Barka Article do not teach or suggest additional features recited by Applicant in independent claims 1, 13 and 17, including, determining, for each independent mode of the plurality of independent modes, a portion of an electromagnetic field contributed by each independent mode; and summing the portion of the electromagnetic field contributed by each independent mode of the plurality of independent

modes to calculate a total electromagnetic field for the aircraft component. For the reasons discussed above, Applicant submits that the the D'Angelo Article and the Barka Article do not teach or suggest these features. Furthermore, Applicant would like to point out that the Examiner has alleged that the the Barka Article teaches the transformation into the plurality of independent modes and the determination of the electromagnetic field for each independent mode, but then alleges that the the D'Angelo Article teaches the summing of electromagnetic field for each independent mode. Applicant submits that the the D'Angelo Article cannot teach or suggest this limitation as the the D'Angelo Article does not teach or suggest an independent mode as acknowledged by the Examiner in the outstanding office action by referring to the the Barka Article. Thus, since the D'Angelo Article and the Barka Article do not teach or suggest all of the limitations recited in independent claims 1, 13 and 17, Applicant respectfully submits that the D'Angelo Article and the Barka Article do not render Applicant's invention as recited in independent claims 1, 13 and 17 obvious.

Next, Applicant respectfully submits that the Examiner has improperly combined the D'Angelo Article and the Barka Article. The Examiner has provided no teaching or suggestion in the D'Angelo Article that would indicate the desirability of incorporating into the D'Angelo Article the modulation algorithm of the Barka Article, nor has the Examiner cited any passage in the Barka Article that would indicate that the modulation algorithm can be used in the finite element formulation of the D'Angelo Article. The Examiner has only made a conclusory statement that it would be "obvious to one of ordinary skill in the art to use Barka et al. to modify D' Angelo et al. since it would be advantageous to capture the RCS from another dimension [in] space for an precise 3-D representation." However, the Examiner provides no support for this conclusion in either the D'Angelo Article or the Barka Article. Thus, Applicant respectfully submits that the Examiner has reached his conclusion based on the teachings in Applicant's specification, which is impermissible hindsight reasoning by the Examiner.

> In making the assessment of differences, section 103 specifically requires consideration of the claimed invention "as a whole." Inventions typically are new combinations of existing principles or features. *Envtl. Designs, Ltd. v. Union Oil Co.*, 713 F.2d 693, 698 [218 USPQ 865] (Fed. Cir. 1983) (noting that "virtually all [inventions] are combinations of old elements."). The "as a whole" instruction in title 35 prevents evaluation of the invention part by part. Without this important

> requirement, an obviousness assessment might break an invention into its component parts (A + B + C), then find a prior art reference containing A, another containing B, and another containing C, and on that basis alone declare the invention obvious. This form of hindsight reasoning, using the invention as a roadmap to find its prior art components, would discount the value of combining various existing features or principles in a new way to achieve a new result – often the very definition of invention.
>
> Section 103 precludes this hindsight discounting of the value of new combinations by requiring assessment of the invention as a whole. This court has provided further assurance of an "as a whole" assessment of the invention under §103 by requiring a showing that an artisan of ordinary skill in the art at the time of invention, confronted by the same problems as the inventor and with no knowledge of the claimed invention, would select the various elements from the prior art and combine them in the claimed manner. In other words, the examiner or court must show some suggestion or motivation, before the invention itself, to make the new combination. See In re Rouffet, 149 F.3d 1350, 1355-56 [47 USPQ2d 1453] (Fed. Cir. 1998).

Ruiz v. A.B. Chance Co., 69 USPQ2d 1686, 1690 (Fed. Cir. 2004)

Applicant submits that the Examiner has impermissibly used Applicant's invention to find its components in the prior art. In the office action, the Examiner appears to pick and choose features from either the D'Angelo Article or the Barka Article to address particular features recited by Applicant in the claims without any further explanation. This is shown in the Examiner's reasoning regarding the independent modes discussed above, wherein the Barka Article is alleged to teach features relating to the independent modes and then suddenly, the the D'Angelo Article is alleged to teach features relating to the independent modes.

Furthermore, "[t]he mere fact that references <u>can</u> be combined or modified does not render the resultant combination obvious unless the prior art suggests the desirability of the combination." *See* Manual of Patent Examining Procedure, 8th Edition (MPEP), Section 2143.01.

In this case the D'Angelo Article explicitly teaches away from the advantage cited by the Examiner in the Office Action. The D'Angelo Article states in the Abstract that the "finite element mesh is truncated using a three-dimensional vector absorbing boundary condition." Thus, it appears to be clear that the the D'Angelo Article is already a precise 3-D representation, and if it is simplified to 2-D, it is simplified on purpose (see the D'Angelo Article, page 535,

right-hand column), therefore, there appears to be no need for the advantage proposed by the Examiner because the D'Angelo Article is already a 3-D representation. The Examiner is reminded that "[i]f the proposed modification or combination of the prior art would change the principle or operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious." *See* MPEP, Section 2143.01.

Therefore, for the reasons given above, independent claims 1, 13 and 17 are believed to be distinguishable from the D'Angelo Article and the Barka Article and therefore are not anticipated nor rendered obvious by the Barka Article.

Dependent claims 2-12, 14-16 and 18-20 are believed to be allowable as depending from what are believed to be allowable independent claims 1, 13 and 17 for the reasons given above. In addition, claims 2-12, 14-16 and 18-20 recite further limitations that distinguish over the applied art. For example, claim 3 recite a Discrete Fourier Transform, which is clearly not taught or suggested by either the D'Angelo Article or the Barka Article. In conclusion, it is respectfully submitted that claims 1-20 are not anticipated nor rendered obvious by the D'Angelo Article and the Barka Article and are therefore allowable.

Objection to the Drawings

The Examiner has apparently maintained the objection to the drawings from the prior Office Action, in which the Examiner requested the labeling of Figures 1-3 as prior art. Specifically, the Examiner stated "[b]y applicants admission, stating 'figures show concepts associated with applicant's invention... to facilitate understanding of the invention' (pg. 16, line 11-13) are ***associated*** and ***not created*** by applicant. Therefore, recommendation stands."

Applicant respectfully traverses the objection to the drawings.

To begin, Applicant is confused by the conclusion drawn by the Examiner relating to "the association" and "the creation" of the drawings by Applicant. The Examiner is requested to further explain how "the association" and "the creation" of a drawing is related to its determination of whether or not it is to be labeled as "prior art." Applicant again submits that Figures 1-3 are illustrations that are used in understanding Applicant's invention and, as such, are part of Applicant's invention and not "prior art." Provided below is Applicant's prior

response to the objection to the drawings which is still believed to be applicable to the Examiner's objection.

> Applicant disagrees with the Examiner's characterization of Figures 1-3 as "prior art" and submits that the Figures show concepts associated with Applicant's invention and, as such, are not prior art. Specifically, the Examiner is referred to 37 C.F.R. 1.81(b) which states that "[d]rawings may include illustrations which facilitate an understanding of the invention." In the present Application, Figures 1-3 provide illustrations of concepts that are used in understanding Applicant's invention and, as such, are not old or "prior art." Furthermore, it is unclear how Applicant's basic design model illustrated in Figure 1 and described in Applicant's Specification at page 4, lines 11-27 can be considered "well-known."

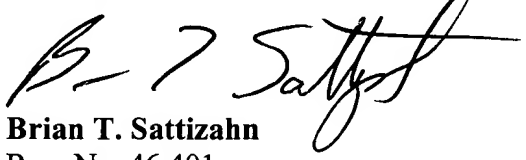
Therefore, in view of the above it respectfully requested that the Examiner reconsider and withdraw the objection to the drawings.

CONCLUSION

In view of the above, Applicant respectfully requests reconsideration of the Application and withdrawal of the outstanding objections and rejections. As a result of the remarks presented herein, Applicant respectfully submits that claims 1-20 are not anticipated by nor rendered obvious by the D'Angelo Article, the Barka Article or their combination and thus, are in condition for allowance. As the claims are not anticipated by nor rendered obvious in view of the applied art, Applicant requests allowance of claims 1-20 in a timely manner. If the Examiner believes that prosecution of this Application could be expedited by a telephone conference, the Examiner is encouraged to contact the Applicant.

The Commissioner is hereby authorized to charge any additional fees and credit any overpayments to Deposit Account No. 50-1059.

Respectfully submitted,
McNEES, WALLACE & NURICK

By 

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